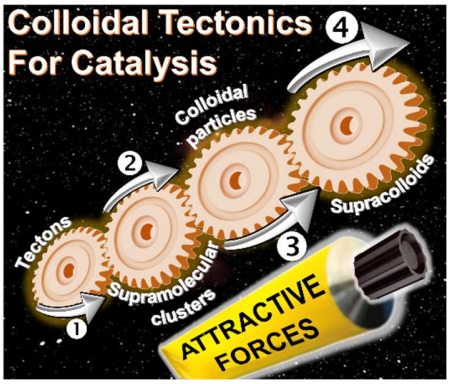
Colloidal tectonics for the engineering of eco-friendly catalytic systems

Loïc Leclercq, Véronique Nardello-Rataj

Colloidal Tectonics for the Engineering of Eco-friendly Catalytic Systems

Véronique Nardello-Rataj and Loïc Leclercq*
Université de Lille, UCCS - UMR CNRS 8181, Bât. C6, F-59655 Villeneuve d'Ascq Cedex, France.
E-mail: loic.leclercq@univ-lille.fr

The interactions between two or more molecules or colloidal particles can be used to obtain a variety of self-assembled systems called supramolecules or supracolloids. There is a clear, but neglected, convergence between these two fields. Indeed, the packing of molecules into colloidal or supracolloidal particles emerges as a smart solution to build an infinite variety of reversible systems with predictable properties. In this respect, the molecular building blocks are called "tectons" whereas "colloidal tectonics" describes the spontaneous formation of (supra)colloidal structures using tectonic subunits.[1] As a consequence, a bottom-up edification is allowed from tectons into (supra)colloidal particles with higher degrees of organization. Here, we propose to highlight a colloidal system which results from ionic metathesis between polyoxometallates (POMs) and cationic surfactants ("hydrophilic" and "hydrophobic" tectons) leading to the formation of uncharged clusters.[2] In aqueous solution, clusters form spontaneously nanoparticles (NPs) in order to decrease the hydrophobic/water contact. These NPs contain parallel inorganic planes of unconnected POMs, separated by interdigitated cationic surfactant chains. Nevertheless, the lamellar structure is completely independent of the size or the shape of the POMs.[3] This internal structure results in a porous particles in which small organic molecules can be accommodated.[1,3] Consequently, in the presence of water and aromatic oil, these particles can be used as surface-active building blocks for the preparation of very stable water-in-oil Pickering emulsions consisting of shell-like microarchitectures that exhibit a high cohesiveness between the particles located in the interfacial layer. Indeed, the penetration of oil molecules into the particles results in the release of some alkyl chains allowing their interlocking and the increase of the interfacial elasticity. These very flexible systems can be useful to obtain catalytic systems.[2,4] Finally, these systems are so flexible that mixed catalytic interface can be obtained.[5]



From tectons to molecular and colloidal engineering of nano- and microcatalytic systems.

References

[1] Leclercq, L. **2018**, *submitted*.
[2] Leclercq, L.; Mouret, A.; Proust, A.; Schmitt, V.; Bauduin, P.; Aubry, J.-M.; Nardello-Rataj, V. *Chem. Eur. J.* **2012**, *18*, 14352-14358. Leclercq, L.; Mouret, A.; Bauduin, P.; Nardello-Rataj, V. *Langmuir* **2014**, *30*, 5386-5393.
[3] Leclercq, L. ; Mouret, A.; Renaudineau, S.; Schmitt, V.; Proust, A.; Nardello-Rataj, V. *J. Phys. Chem. B.* **2015**, *119*, 6326-6337. Pera-Titus, M.; Leclercq. L.; Clacens, J.-M.; De Campo, F.; Nardello-Rataj, V. *Angew. Chem. Int. Ed.* **2015**, 54, 2006-2021. Mouret, A.; Leclercq L.; Mühlbauer, A. ; Nardello-Rataj, V. *Green Chem.* **2014**, *16*, 269-278.
[5] Yang, B.; Leclercq, L.; Pera-Titus, M.; Nardello-Rataj, V. **2018**, manuscript in preparation.